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Re: OPHARDT, Heiner
U.S. Patent Application Serial No. 10/810,615
Art Unit : 3754
Our Case: P41303 Filing Date: March 29, 2004
Title: Manual or Pump Assist Fluid Dispenser

Dear Sir:

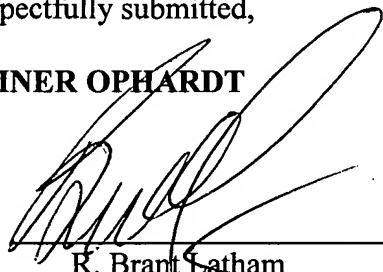
Enclosed herewith is the certified copy of the priority Canadian patent application Serial No. 2,432,814, filed June 19, 2003 and entitled "Manual or Pump Assist Fluid Dispenser" in which priority claim has been made in regard to the above-noted application.

The Patent Office is requested to confirm that the priority application Serial No. 2,432,814 has now been made of record.

Respectfully submitted,

HEINER OPHARDT

By:


R. Brant Latham
Reg. No. 30,013

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Specification and Drawings, as originally filed, with Application for Patent Serial No:
2,432,814, on June 19, 2003, by HYGIENE-TECHNIK INC., assignee of Heiner Ophardt,
for "Manual or Pump Assist Fluid Dispenser".

Gray Paulhus
Agent certificateur/Certifying Officer

April 7, 2004

Date

Canada

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ABSTRACT

A chamber about an opening of an inverted container with an impeller within the chamber which, on rotation, dispenses fluid from the chamber.

Title**MANUAL OR PUMP ASSIST FLUID DISPENSER****Scope of the Invention**

[0001] This invention relates to a fluid dispenser and, more particularly, to a fluid dispenser for automated and/or manual pumping operation.

Background of the Invention

[0002] Most known soap dispensers suffer the disadvantage that they do not provide for inexpensive simple and/or energy efficient systems to dispense fluid, particularly when the systems are for automatically dispensing fluids with motor driven pumps. As a further disadvantage, known systems which use motor driven pumps do not permit for manual dispensing of the liquid as an alternative to dispensing with the motor driven pump as, for example, in the situation where the pump is inoperative. The pump may be inoperative as, for example, by reason of malfunction of the pump mechanism or the loss of power as, for example, under power failure conditions or if batteries to drive the pump have become depleted.

Summary of the Invention

[0003] To at least partially overcome these disadvantages of previously known devices, the present invention provides in one aspect a chamber about an opening of an inverted container with an impeller within the chamber which, on rotation, dispenses fluid from the chamber. More preferably, the chamber is a vacuum relief chamber.

[0004] An object of the present invention is to provide a simplified fluid dispenser which provides for a motor driven pump to dispense fluid.

[0005] Another object of the present invention is to provide a fluid dispenser with a motor driven pump to dispense fluid which system is particularly adapted for use with batteries and is of low cost.

[0006] Another object is to provide a fluid dispenser which permits dispensing by driving a pump through use of a motor or manual activation.

[0007] Another object is to provide a liquid dispenser which is resistant to dripping liquid therefrom when not in use.

[0008] Accordingly, in one aspect, the present invention provides a liquid dispenser comprising:

[0009] a resilient, enclosed container enclosed but for having at one end of the container a neck open at a container outlet opening,

[0010] a cap having an end wall and a side wall of extending upwardly from the end wall to a remote portion of the side wall,

[0011] a cap outlet opening through the side wall,

[0012] the cap received on the neck with the neck extending into the cap,

[0013] the remote portion of the cap about the neck engaging the neck to form fluid impermeable seal therewith,

[0014] a passageway defined between the neck and the side wall of the cap outwardly of the neck and inwardly of the side wall open to both the container outlet opening and the cap outlet opening,

[0015] wherein when the container is in an inverted position with the neck located below the remainder of the container, the container outlet opening is at a height which is below a height of the cap outlet opening,

[0016] the side wall of the cap being disposed about an axis,

[0017] the container outlet opening disposed coaxially within the side wall of the cap,

[0018] an impeller disposed in the cap above the end wall of the cap and at least partially below the container outlet opening journaled for rotation about the axis,

[0019] the impeller adapted on rotation to receive fluid above the impeller from the container outlet opening and to direct liquid radially outwardly into the passageway such that rotation of the impeller forces fluid into the passageway raising the level of fluid in the passageway to a height above the height of the cap outlet opening such that fluid flows out of the cap outlet opening.

[0020] the impeller when not rotating not preventing air flow from the cap outlet opening to the container outlet opening.

[0021] In another aspect, the present invention provides a liquid dispenser comprising:

[0022] an enclosed resilient container enclosed but for having at one lower end of the container a neck open at a container outlet opening,

[0023] the container outlet opening in sealed communication with a chamber forming element defining a chamber,

[0024] the chamber having an air inlet and a liquid inlet,

[0025] the liquid inlet open to the chamber at a height which is below a height at which the air inlet is open to the chamber,

[0026] the air inlet in communication with air at atmospheric pressure such that the chamber is at atmospheric pressure,

[0027] the liquid inlet connected via a liquid passageway with liquid in the container,

[0028] the liquid inlet at a height below a height of liquid in the container such that when pressure in the container is atmospheric pressure, due to gravity, the liquid from the container fills the liquid passageway and, via the liquid passageway, fills the chamber to a height above the height of the liquid inlet and below the height of the air inlet, and wherein on dispensing liquid from the container increases vacuum below atmospheric in the container, the height of liquid in the chamber decreases until the height of liquid is below the height of the liquid inlet and the liquid inlet is open to air in the chamber such that air in the chamber flows under gravity upward through the liquid passageway to the container to decrease vacuum in the reservoir,

[0029] an impeller rotatably received in the chamber for rotation to draw liquid via the rigid passageway from the container and raise the height of liquid in the chamber above the height of the air inlet.

Brief Description of the Drawings

[0030] Further aspects and advantages of the invention will become apparent from the following description taken together with the accompanying drawings in which:

[0031] Figure 1 is a perspective view of a soap dispenser in accordance with a first embodiment of the present invention;

[0032] Figure 2 is a schematic exploded partially cross-sectional view of the soap dispenser of Figure 1;

[0033] Figure 3 is a end view of the bottle as seen in cross-section 3-3' in Figure 3;

[0034] Figure 4 is a cross-sectional view through the cap as seen along section line 4-4' in Figure 5;

[0035] Figure 5 is a partial cross-sectional view of the soap dispenser of Figure 1 in a closed condition;

[0036] Figure 6 is a view similar to that in Figure 3 but showing the soap dispenser in an open position;

[0037] Figure 7 is a view the same as that in Figure 6 but showing the entire dispenser;

[0038] Figure 8 is a cross-sectional side view of a modified bottle for use with a dispenser similar to the first embodiment;

[0039] Figure 9 is a schematic pictorial view of a manually operated lever mechanism to compress a bottle similar to that in the first embodiment;

[0040] Figure 10 is a cross-sectional view similar to Figure 6 but of a dispenser in accordance with a second embodiment of the invention;

[0041] Figure 11 is a vertical rear cross-sectional view of a dispenser in accordance with a third embodiment of this invention;

[0042] Figure 12 is a cross-sectional view along section line 12-12' in Figure 11;

[0043] Figure 13 is a cross-sectional view similar to Figure 6 but of a dispenser in accordance with a third embodiment of this invention;

[0044] Figure 14 is a cross-sectional view along section line 14-14' in Figure 13; and

[0045] Each of Figures 15 to 21 illustrate arrangements of a fluid reservoir, a pressure relief mechanism and a pump for use as a fluid dispenser.

Detailed Description of the Drawings

[0046] Reference is made to Figures 1 to 7 which show a first embodiment of a fluid dispenser in accordance with the present invention.

[0047] Figure 1 shows the dispenser 200 including a bottle 202 and a cap 204.

[0048] The bottle 202 has a body 206 which is rectangular in cross-section as seen in Figure 3 and a neck 208 which is generally circular in cross-section about a longitudinal axis 210. The neck 208 includes a threaded inner neck portion 212 carrying external threads 214. The inner portion 212 merges into a liquid tube 42 which ends at the container outlet opening 44.

[0049] The cap 204 has a base 34 from which a side wall 36 extends upwardly to a remote upper opening 37. The side wall 36 includes a remote upper portion 230 carrying internal threads 216 adapted to engage the threaded neck portion 212 of the bottle 202 in a fluid sealed engagement. An air tube 38 extends radially from the side wall 36. The side wall 36 has a cylindrical lowermost portion 228 rising up from the base 34 and merging into an upwardly opening frustoconical portion 229 which merges at its upper end with the remote cylindrical portion. The air tube 38 extends radially from the uppermost remote portion below the threads 216.

[0050] The cap includes a supporting portion 238 having a side wall 240 which extends outwardly and downwardly from about the base 34 to a planar support surface 242 adapted to engage a planar desktop or work surface or the like and support the dispenser in a vertical orientation as shown. A chamber 244 is defined within the supporting portion 238.

[0051] An impeller 250 is provided within the cap 204 above the base 34 and inside the cylindrical side wall 36. The impeller 250 is arranged for rotation about the axis 210. In this regard in the preferred embodiment, a shaft opening 252 is provided coaxially of the axis 210 through the base 34. A shaft 254 extends through this opening 252 and is coupled at its upper end to the impeller 250 and at its lower end to a motor 256 securely supported within the chamber 244. A sealing ring is disposed about the shaft 254 in the opening 252 providing a fluid impermeable seal to prevent liquid from passing outwardly through the opening 252. When the motor 256 is activated, the impeller rotates about the axis 210.

[0052] Reference is made to Figure 5 which shows the dispenser in an assembled closed position. In this position, the neck 208 of the bottle 202 is threaded downwardly into the cap 204 to an extent that the lower periphery of the liquid tube 42 of the bottle

engages the interior surface of the frustoconical portion 229 of the side wall 36 and seals the liquid tube 42 so as to effectively prevent the flow of fluid into or out of the bottle 202.

[0053] From the position of Figure 5, by relative rotation of the bottle 202 relative the cap, as preferably 180 degrees, an open position is assumed in which the inlet 44 of the liquid tube 42 of the neck of the bottle is displaced vertically from the side wall 36 of the cap in a manner which will permit flow of fluid and/or air into and/or out of the bottle. In the open position of Figure 6, the cap 204 and the neck 208 of the bottle cooperate to function as vacuum relief valve.

[0054] In this regard, the bottle 202 is preferably a resilient plastic bottle, as formed by blow molding, which has an inherent bias to assume an inherent shape having an inherent internal volume. The bottle may be compressed as by having its side surface moved inwardly so as to be deformed to shapes different than the inherent shape. The bottle may be deformed to shapes different than the inherent shape with volumes less than inherent volume and from which deformed shapes the bottle will have an inherent bias to assume its original inherent shape.

[0055] In combination, the cap 204 and the neck 208 of the bottle form an enclosed chamber 33 having an air inlet 40 via air tube 38 in communication with air at atmospheric pressure and a liquid inlet 44 in communication with liquid in the reservoir bottle 202 via the liquid tube 42. The liquid inlet 44 is open to the chamber 33 at a height which is below a height at which the air inlet 40 opens into the chamber 33.

[0056] Figures 6 and 7 illustrate an assembled open position after fluid has been dispensed and the system has been left to assume its own equilibrium. The lower portion of the bottle is filled with liquid 26 with an upper portion of the bottle including air 27. Liquid in the chamber 33 is at a height above the liquid inlet 44 but below the air inlet 40 and air tube 38. Because the height of the fluid in the chamber 33 is below the inlet tube 38, fluid does not flow out from the chamber 33. Fluid does not flow out of the bottle 202 down into the chamber 33 as a result of vacuum which is developed within the bottle 202.

[0057] The configuration of the cap 204 and neck of the bottle shown in Figure 6 acts as a vacuum relief device in that insofar if a sufficient vacuum is developed within the bottle 202, then the inherent resiliency of the bottle will draw liquid from the chamber 33 upwardly into the bottle 202 until the level of liquid within the chamber 33 reaches or passes below the level of the liquid inlet 44. At this point, air in the chamber 33 will enter into the bottle and pass upwardly into the bottle. Once sufficient air has entered into the bottle, the vacuum within the bottle 202 becomes relieved sufficiently that the level of fluid within the chamber 33 will be equal to or above the liquid inlet 44 at which point no further air may then enter the bottle 202 to further relieve the vacuum in the bottle.

[0058] The vacuum in the bottle may be created by drawing liquid from the bottle by operation of the impeller or by compressing the bottle to reduce its volume and then releasing the bottle.

[0059] As seen in Figure 6, the liquid tube 42 is coaxial within the cap 204 and an annular passageway 41 is defined between the side wall 36 and the liquid tube 42. As seen in Figure 6, the chamber 33 includes this annular passageway 41 between the side wall 36 and the liquid tube 44. The air inlet 40 and the air tube 38 open into this passageway 41. As seen in Figure 5, in an assembled closed position, the annular passageway 41 is closed at its lower end to the remainder of the chamber 33 by reason of the engagement between the liquid tube 42 and the side wall 36. In contrast as seen in Figure 6, there is an annular opening to the passageway 41 formed as an annular gap between the end of the liquid tube 42 and the side wall 36.

[0060] In the open position as seen in Figure 6, liquid may be dispensed from the bottle 202 in two manners.

[0061] Firstly, liquid may be dispensed from the bottle 202 by compressing the bottle 202 so as to reduce its volume. Thus, a user may manually compress the bottle 202 as by grasping the bottle and urging opposite sides of the bottle together. This compression attempts to reduce the volume of the bottle, applying pressure to the contents in the bottle and thus forcing liquid out of the liquid tube 42 into the chamber 33 increasing the level of liquid in the chamber 33 to an extent that the level of liquid reaches the height of the

air tube 38 and liquid flows and/or is forced out of the air tube 38 to atmosphere. On release of the compressive forces on the bottle, the bottle will under its inherent bias attempt to assume its inherent shape and thus will, due to the vacuum in the bottle, draw liquid and/or air in communication with the liquid inlet 44 back upwardly into the bottle. In this manner, liquid in the chamber 33 will be drawn back into the bottle until the level of liquid in the chamber 33 becomes below that of the liquid inlet 44 and air may be drawn back into the bottle 202 to an extent to at least partially relieve the vacuum in the bottle 202.

[0062] Rotation of the impeller 250 is the second manner to dispense liquid from the container 33. On activation of the motor 356, the impeller 250 is rotated about the vertical axis 210. The impeller 250 is shown as having a circular disc 251 disposed normal the axis and three axially and radially extending circumferentially spaced vanes 249. Rotation of the impeller 250 directs fluid radially outwardly from the center of the impeller. Particularly, with the impeller 250 shown, fluid which is above the impeller as from the liquid inlet 44 is directed by the impeller to be urged radially outwardly and, hence, through the gap between liquid tube 42 and side wall 36 and into the annular passageway 41. Fluid is urged radially into the passageway 41 to an extent that the level of the fluid in the passageway 41 rises above the height of the air tube 38 and thus liquid exits from the chamber 33 via the air tube 38. The rotation of the impeller 250 thus draws fluid downwardly from the bottle 202 and pumps it as in the manner of a circumferential pump via the annular passageway 41 upwardly to exit from the air inlet 40. By so drawing fluid from the bottle 202, an increased vacuum condition is created in the bottle 202. When the motor is deactivated and the impeller 250 stops to rotate, the increased vacuum condition exists in the bottle 202 and thus the inherent tendency of the bottle to assume its inherent shape will draw liquid and/or air in the chamber 33 back into the bottle 202 to relieve vacuum in the bottle in the same manner as described earlier. The configuration of the impeller 250 does not impede the flow of liquid and/or air between the liquid inlet 44 and the air inlet 40 for passage of liquid out of the bottle or the passage of liquid and/or air into the bottle.

[0063] It follows, therefore, that the liquid dispenser as shown in the first embodiment is adapted for dispensing fluid either manually by compressing the bottle or automatically by motor operation of the pump.

[0064] In the case that the motor is inoperative, the dispenser may therefore be used manually without modification.

[0065] Reference is made to Figures 5 and 6 which schematically show a mechanism for operation of the motor 356. Schematically shown are a battery 364, a control circuit board 366 and a switch 368. Wiring to connect these components is not shown. The switch 368 illustrated preferably comprises an infrared transmitter and receiver which will emit light and sense such light as reflected from a user's hand placed underneath the air tube 38. Under such conditions, the control circuit board 366 will operate the impeller 250 for a desired period of time as may be selected to dispense an appropriate allotment of liquid. The operation of the sensor switch and motor may be controlled by a simple control circuit as in a known manner.

[0066] The particular nature of the switch 368 may vary and the switch could alternatively comprise a simple on/off switch manually to be activated by a first hand of a user while a second hand of the user is placed underneath the air tube 38.

[0067] While a battery 364 is shown, the motor could, of course, be operated by a remote electrical power source.

[0068] The motor 356 is preferably an inexpensive, wound electrical DC motor which operates at relatively high rotational speed and will have minimal power requirements. The impeller 250 is preferably selected having regard to the nature of the motor and the viscosity of the fluid to provide for relatively high speed rotation of the impeller by the motor with minimal power draw. The relative configuration of the cap 204 and the neck 208 of the bottle is preferably selected having regard to the impeller, motor and power available to the motor to minimize the height to which the impeller must force the fluid up into the passageway 41 in order to dispense liquid.

[0069] Preferred, inexpensive electric motors are those which have power ratings in the range of 1.0 to 0.2 watts. For example, one preferred motor is available under the

trade name Mabuchi as model number RE-260 RA-18130 which draws about .1 amps at 3 volts DC when unloaded or about 0.05 amps at 6 volts DC.

[0070] To the extent it is desired to minimize power consumption, then the relative size of each of the impeller vanes 249 may be minimized to permit with reduction of the impeller blade size increased speed of rotation of the impeller other considerations remaining the same.

[0071] The particular configuration of the impeller may vary to a wide extent. For example, the impeller may have a second circular upper plate parallel to the lower plate 251 and spaced therefrom with the vanes 249 in between and a central opening through the upper plate to permit fluid flow centrally between the plates and, hence, radially outwardly as directed by the vanes. The simplified impeller as illustrated is believed preferable so as to permit generation of a swirling vortex as below the liquid tube 42 centrally thereof which is believed to enhance the flow of fluid radially and upwardly via the annular passageway 41.

[0072] In the preferred embodiment, the container 202 is illustrated as being open only at its liquid inlet 44. Preferably, the liquid dispenser comprising both the cap 34 and the bottle 202 may be transported and stored before use in a position with the neck of the bottle up and may be inverted to the position shown in Figure 5 only prior to initial use.

[0073] The dispenser in accordance with the present invention is particularly adapted for dispensing liquid such as liquid soap and other cleaners. The dispenser is particularly advantageous for liquids which do not have a high viscosity and is found to be useful with typical liquid soaps commercially available.

[0074] The dispenser has also been found to be particularly advantageous for dispensing liquids which have viscosities roughly approximately to that of water and liquids such as alcohol based disinfectants as used in hospitals which have viscosities less than that of water.

[0075] In that of normal operation of the liquid dispenser of the first embodiment, the vacuum in the bottle 202 draws liquid back from the air tube 38 into the chamber 33, the system thus inherently prevents dripping of liquid from the air tube 38.

[0076] The preferred embodiment illustrated shows the liquid tube 42 as being cylindrical and as having a radius substantially equal to the radius of the side wall 36 over the lower cylindrical portion 228. The impeller 250 is shown as being sized to have a radial extent marginally less than the radius of the side wall 36 in the lower portion 228. The preferred embodiment shows the side wall 36 as including the frustoconical portion 229 which opens upwardly from the cylindrical lower portion. Many modifications and variations will occur to persons skilled in the art. For example, the impeller may be provided in a lower portion of the cap 204 which has a radius which is greater than a radius of the liquid tube 42 with the impeller having a radius less than, equal to or greater than the radius of the liquid tube 42, however, is believed to be preferred if the radius of the impeller is only marginally smaller than the radius of the side wall 36 radially outwardly from the impeller.

[0077] In the preferred embodiment, given that the energy consumption of the motor is preferably selected to be low, a system comprising in combination a rechargeable battery and a small solar panel carried on the cap may well comprise an advantageous configuration.

[0078] In accordance with the preferred embodiment, the cross-sectional area of the passageway 41 which is open to the radial discharge from the impeller 250 is relatively large. This is advantageous such that only a minimal increase in pressure is required in order to raise the level of fluid in the chamber 33 to a point that the level of fluid is above the air tube 38 and fluid may thus be dispensed.

[0079] Reference is made to Figure 8 which illustrates a modified bottle 202 for use with an arrangement similar to that shown in Figures 1 to 7. The modified bottle 202 carries a semi-spherical bulbous protrusion 260 on one side of the bottle 202 which is adapted for manual engagement to compress the bottle and dispense fluid. The bottle 202 is illustrated in combination with a hard shroud 262 to cover the bottle which shroud could, for example, form part of a housing as to secure the dispenser to a wall 264. Preferably, the bulbous protrusion 260 on the bottle 202 may extend out through an opening 266 in the shroud 262. The protrusion effectively serves as an enlarged push

surface which a user could engage with his hand and urge into the wall supporting the housing, thus, effectively manually compress the bottle and dispense fluid.

[0080] Reference is made to Figure 9 which shows another mechanism to manually compress the bottle. A lever 270 is mounted for pivoting about axis 272 to a housing (not shown) and includes one end 274 of the lever which is adapted for manual engagement by a user and another end 276 of the lever which would then be urged into the compressible bottle 202 to compress the same. Such a arrangement is, in the simple sense, illustrated in Figure 9.

[0081] Reference is made to Figure 10 which shows a cross-sectional view similar to Figure 6 but of a second embodiment of the present invention.

[0082] The embodiment in Figure 10 is modified in two respects over that of Figure 6.

[0083] Firstly, in addition to the air tube 38 and the air inlet 40, a secondary air inlet is provided as an opening 400 through the side wall 36 of the cap 204 at a height above the air tube 38.

[0084] As a second modification over that shown in Figure 5, the impeller 250 in Figure 10 is rotated by a magnetically coupled drive mechanism. Magnetically coupled drive mechanisms are known. A suitable drive is taught, for example, by U.S. Patent 3,306,221 to Goodpasture issued February 28, 1967. As seen in Figure 10, the side wall 36 extends downwardly to form with the base 34 an enclosed cylindrical lower portion 228 within which the impeller 250 is rotatable journaled coaxially about the axis 210 by reason of a stub axle 253 extending downwardly and being received in a journaling blind bore in the base 34. Secured about the stub axle 253 is a driven magnet 402.

[0085] Coaxially about the lower cylindrical portion 228 is an annular driver magnet 404 carried on a cylindrical cup-shaped carrier 406 which is journaled for rotation about the axis 210 and rotated by being coupled via the shaft 254 to the motor 256. In a known manner, rotation of the driver magnet 404 by the motor 256 causes the driven magnet 402 and therefore the impeller 250 to rotate. Such magnetically coupled motors are commercially available and have the advantage that no seal is required between the impeller and the motor.

[0086] Operation of the embodiment in Figure 10 is identical to that described with the first embodiment, that is, when the impeller is not rotating, the liquid 26 establishes a level which is intermediate the air inlet 40 and the liquid inlet 44 as maintained by the at least partial vacuum within the bottle 202. On rotation of the impeller 250, liquid is pumped axially through the passageway 41 and out of the air tube 38. The air opening 400 is provided so as to facilitate continuous dispensing of fluid.

[0087] With many soap dispensers, it is desired to merely dispense individual dosages of liquid with each operation of the pump. This can be accomplished in many manners such as by controlling the time of operation of the pump and the like. In accordance with the first embodiment as illustrated in Figure 6, the dispenser can be arranged such that on rotation of the impeller 250, on dispensing of the liquid from the air tube 38, a vacuum becomes developed in the bottle 202 to an extent that the pump is not capable of pumping an additional amount of liquid out of the air tube. Thus, while the impeller 250 may continue to rotate and create a vortex within the cap, the vacuum created in the bottle 202 will prevent dispensing an additional amount of liquid.

[0088] This can be an advantageous manner of operating the pump of Figure 6 such that inherently due to the vacuum created within the bottle 202, on operation of the motor and even with continued operation of the motor only, a predetermined dosage of liquid may be able to be dispensed given that after dispensing a certain amount of liquid, a vacuum is created in the bottle which prevents further liquid from being dispensed. Thus, even if the impeller may be rotated for some additional time, merely a single dosage of liquid will be dispensed. To dispense a second dosage requires stopping rotation of the impeller which will then let the liquid in the passageway 41 be drawn back under the vacuum in the bottle such that air may come to be below the liquid inlet 44 and, hence, relieve the vacuum in the bottle.

[0089] In accordance with the embodiment illustrated in Figure 10, the secondary air inlet provided by air opening 400 can be of assistance in permitting continuous dispensing of liquid from the container. In the embodiment of Figure 10, with the rotation of the impeller and on liquid passing out through the air tube 38 and substantially filling the air tube 38 as shown, the secondary air inlet provided by the opening 400 can

permit air to enter into the passageway 41. A significant vortex which can be set up in the passageway 41 tends to urge liquid against the outer wall 36 of the cap and assists in permitting air to extend radially inwardly adjacent the liquid tube 44 and move downwardly to the liquid inlet 44 and, hence, pass upwardly into the bottle 202 to relieve the vacuum therein and thus permit continuous pumping. Figure 10 illustrates a condition in which the impeller 250 is rotated at high speed and a vortex has been set up not only internally within the liquid tube 42 but also within the passageway 41 where the vortex has an air liquid interface.

[0090] In Figure 10, air is shown to conceptually pass downwardly in the vortex and hence up the liquid tube 42 as illustrated by bubbles 408.

[0091] Reference is made to Figures 11 and 12 which show a third embodiment of the invention in accordance with the present invention and in which similar reference numerals are used to refer to similar elements. The embodiment of Figures 11 and 12 illustrates a configuration in which the impeller 250 is disposed for rotation about a horizontal axis 420. As seen in Figure 11, the bottle 202 is threadably connected to a right angled feed tube 422 which directs fluid 26 from the bottle 202 into a pump housing 424 which has a lower portion 246 with a generally cylindrical side wall 248 and which merges upwardly into an upper portion 250 from which the air inlet tube 38 extends outwardly to the air outlet 40. The feed tube 422 effectively extends the liquid tube 42 on the bottle and provides an effective liquid inlet 444 which, as best seen in Figure 11, is disposed below the air inlet 40. The liquid inlet 444 is illustrated as to its location in dotted lines in Figure 12 and provides an inlet to the centre of the impeller 250. With rotation of the impeller 250, the vanes on the impeller direct liquid circumferentially outwardly and, thus, act in the manner as a centrifugal pump to pump fluid from the liquid tube 42 upwardly to raise the liquid in the housing 424 to a height that the liquid can flow out the air tube 38.

[0092] Use of an impeller such as that shown in Figure 11 advantageously permits air and liquid to flow between the bottle 202 and the air tube 38 when the impeller is not rotating as is advantageous for manual dispensing of liquid as by compressing the bottle

202, and, for vacuum relief by passage of air from the air tube 38 back into the bottle 202.

[0093] While the preferred embodiments show impellers disposed for rotation about a vertical or a horizontal axis, it is to be appreciated that the impellers may be adapted for rotation about an axis disposed at almost any angle as may be convenient.

[0094] Reference is made to a fourth embodiment of a dispenser in accordance with the present invention as illustrated in Figures 13 and 14.

[0095] This embodiment has many similarities to the first embodiment, however, notable differences are that the bottle 202 is a rigid substantially non-compressible bottle.

[0096] The cap 204 and neck of the bottle 208 are modified so as to not form a vacuum release device as with the first embodiment. In this regard, the outlet tube 38 in Figure 10 exits from the side wall 36 of the cap at a lowermost portion of the cap. No air is intended to be in the system other than at the upper end of the bottle. A vacuum relief tube 300 is provided which extends to one side of the impeller 250 vertically upwardly into the bottle 202 to the upper end of the tube. The air inlet tube 300 has its lower end engaged in a passageway 600 which passes downwardly through the cap and is joined by a radial passageway 602. A valve 608 only schematically illustrated is disposed in the passageway 600 tube within the cap biased to a closed position and arranged to be opened electrically as in the manner of a simple solenoid valve.

[0097] The outlet tube 38 extends upwardly and then downwardly to an exit opening 40. With operation of the impeller 250 by the motor, with the solenoid valve 608 open, relatively low pressure is required to be generated by the impeller 250 to pump fluid out the inlet tube 38. When the impeller is stopped from rotating, the solenoid valve 608 closes and the up and down path of the outlet tube 38 will prevent any substantial dripping of liquid from the outlet 40 since the bottle 202 is non-compressible and the valve 608 closes the air relief tube 300. The impeller and its motor provides a convenient, inexpensive centrifugal pump arrangement for dispensing fluid with vacuum relief to the bottle being provided via the vacuum relief tube 300 and its solenoid valve 602.

[0098] The solenoid valve is biased to a closed position and may be opened during at least part of the time when the impeller is rotated thus facilitating flow of liquid from the bottle due to gravity and assisted by rotation of the impeller. The valve can be controlled by the control circuit for closing of the valve in a time cycle relative the activation and deactivation of the motor, possibly more preferably with the impeller to continue rotating for sometime after the valve is closed to assist in creating at least a partial vacuum within the bottle.

[0099] Reference is now made to Figures 15 to 21 each of which include a reservoir 500, a pressure relief device 502 and a pump 504. In each case, a liquid tube 42 exits from the reservoir and is disposed with its liquid inlet within the pressure relief device 502 at a height below an air tube 38 and its air outlet with a level of liquid in the pressure relief device 502 being intermediate the liquid inlet and the air inlet.

[0100] Figure 15 illustrates a condition in which the pump 504 is connected to the reservoir. On operation of the pump to dispense fluid from the reservoir 500, a vacuum may be developed in the reservoir 500 to an extent as permitted by the vacuum relief device 502 which, at some point, will permit air to be drawn up the liquid tube 42 to relieve the pressure in the reservoir 500. Figure 15 permits continuous dispensing.

[0101] Figure 16 illustrates a condition in which the pump 504 is connected to a lower liquid sump portion of the pressure relief device 502 below the level of the liquid. On activation of the pump, liquid is drawn from the reservoir 500 into the sump of the pressure relief device 502 and air may enter the air tube 38 to relieve vacuum developed in the reservoir 500.

[0102] Figure 17 illustrates an arrangement in which the pump 504 is disposed within the sump of the pressure relief device 502 and the pump receives fluid from the liquid tube 42 connected to the reservoir. The pump discharges liquid into the pressure relief device. Liquid is discharged from the air tube 38 and the arrangement is adapted for both air and liquid flow through the tube 38 and, as well, air and liquid flow through the pump 504.

[0103] Figure 18 illustrates an arrangement similar to Figure 15, however, in which the pump 504 discharges to the sump of the pressure relief device 502.

[0104] Figure 19 illustrates a condition similar to Figure 16, however, in which the air tube 38 is joined to a liquid outlet 508 from the pump 504.

[0105] Figure 20 illustrates an arrangement similar to Figure 16, however, in which the pump 504 is internal within the sump of the pressure relief device 502.

[0106] Figure 21 illustrates a condition similar to Figure 20, however, in which the air tube 38 is connected to the outlet 508 from the pump 504.

[0107] The embodiment illustrated in Figures 1 to 7 is schematically shown in Figure 17 in which embodiment both the air and liquid must pass inwardly and outwardly through the pump 504, as well as through the air tube 38 and the liquid tube 42. Such arrangements require a pump which permits flow inwardly and outwardly such that the arrangement can permit air to enter the reservoir 500 to relieve vacuum in the reservoir. As well, such a configuration permits dispensing by manually compressing the reservoir.

[0108] In the arrangement of Figure 15, the pump 504 preferably merely permits flow outwardly. The arrangement of Figure 15 nevertheless will permit manual operation when the pump is not operative by compressing the reservoir 500. Similarly in Figure 16, the pump 504 is intended to merely permit fluid flow outwardly. The arrangement of Figure 16 will also permit manual dispensing by compressing of a compressible container 500.

[0109] In the arrangement of Figure 18, the pump 504 preferably merely permits fluid flow in one direction, however, may permit fluid and/or air flow in both directions therethrough. In either event, the arrangement of Figure 18 is adapted for manual dispensing by compressing the container 500. In Figure 18, whether operated by the pump or manual compression, both air and liquid will pass out through the air tube 38, however, it is not necessary that the pump 504 permits fluid flow other than outwardly from the reservoir 500.

[0110] The arrangement of Figure 20 is substantially of the same effect as that in Figure 16 with the pump 504 to merely permit liquid flow outwardly. The difference between Figure 20 and Figure 16 is that in Figure 20, the pump is shown as being located internally within the sump of the liquid control device which may be convenient.

[0111] Figure 21 is an arrangement substantially the same as that shown in Figure 20, however, with the air tube 38 connected to the pump discharge tube 508 and in the embodiment of Figure 21, it is preferred that the pump merely permit liquid flow outwardly.

[0112] In each of the embodiments of Figures 15 to 21, the container preferably is a collapsible container with an inherent bias to assume an inherent shape. The flow of air or liquid from the various openings is indicated for air by the letter "A" or for liquid by the letter "L".

[0113] While the invention has been described with reference to the preferred embodiments, many variations and modifications will now occur to a person skilled in the art. For a definition of the invention, reference is made to the appended claims.

I CLAIM:

1. A liquid dispenser comprising:
 - a resilient, enclosed container enclosed but for having at one end of the container a neck open at a container outlet opening,
 - a cap having an end wall and a side wall of extending upwardly from the end wall to an remote portion of the side wall ,
 - a cap outlet opening through the side wall,
 - the cap received on the neck with the neck extending into the cap,
 - the remote portion of the cap about the neck engaging the neck to form fluid impermeable seal therewith,
 - a passageway defined between the neck and the side wall of the cap outwardly of the neck and inwardly of the side wall open to both the container outlet opening and the cap outlet opening,
 - wherein when the container is in an inverted position with the neck located below the remainder of the container, the container outlet opening is at a height which is below a height of the cap outlet opening,
 - the side wall of the cap being disposed about an axis,
 - the container outlet opening disposed coaxially within the side wall of the cap,
 - an impeller disposed in the cap above the end wall of the cap and at least partially below the container outlet opening journaled for rotation about the axis,
 - the impeller adapted on rotation to receive fluid above the impeller from the container outlet opening and to direct liquid radially outwardly into the passageway such that rotation of the impeller forces fluid into the passageway raising the level of fluid in the passageway to a height above the height of the cap outlet opening such that fluid flows out of the cap outlet opening,
 - the impeller when not rotating not preventing air flow from the cap outlet opening to the container outlet opening.

2. A liquid dispenser as claimed in claim 1 wherein the impeller when not rotating not preventing air flow or fluid flow between the container and cap.
3. A liquid dispenser as claimed in claim 1 wherein the impeller forms with the cap and container neck a centrifugal pump to direct fluid from the container outlet opening radially into the passageway.
4. A liquid dispenser as claimed in claim 3 wherein the cap is circular in cross-section about the axis, the neck of the container is circular in cross-section about the axis, and
the passageway is annular about the axis.
5. A liquid dispenser as claimed in claim 1 wherein the impeller has a radial extent not substantially less than a radial extent of the container outlet opening
6. A liquid dispenser as claimed in claim 1 wherein the impeller has a radial extent at least equal to a radial extent of the container outlet opening.
7. A liquid dispenser as claimed in claim 1 wherein the side wall of the cap has a lower cylindrical portion of a radius marginally greater than a radial extent of the impeller.
8. A liquid dispenser as claimed in claim 7 wherein the neck of the container has a lower cylindrical portion ending at the container outlet opening of a radius substantially the same as the radius of the lower cylindrical portion of the cap.
9. A liquid dispenser as claimed in claim 7 wherein the side wall of the cap opens upwardly from the lower cylindrical portion as a frustoconical portion.

10. A liquid dispenser as claimed in claim 1 wherein the container is resiliently deformable with an inherent shape having an inherent internal volume,

the container being resilient such that after being deformed by forces forcing the container to assume shapes different than its inherent shape and having volumes less than the inherent volume, on release from such forces, the resiliency of the container biases the container toward reassuming its inherent shape and creating a vacuum in the container,

when the container, in the inverted position, is deformed to the shapes different than the inherent shape, then liquid in the container is forced to flow out of the container via the container outlet opening through the passageway and out the cap outlet opening,

when a vacuum exists in the container with the container in an inverted position, liquid in the cap is drawn back into the container until the height of liquid in the cap is below the height of the container outlet opening and the container outlet opening is open to air in the cap such that air in the cap flows under gravity upward through the neck into the container to decrease vacuum in the container,

the container outlet opening at a height below a height of liquid in the container such that when pressure in the container is atmospheric pressure, due to gravity, the liquid from the container fills the neck and passageway to a height above the height of the container outlet opening and below the height of the cap outlet opening,.

11. A liquid dispenser as claimed in claim 1 wherein the cap is movable relative the neck between a closed position in which the cap prevents fluid flow through the passageway and an open position in which the passageway is open to fluid flow.

12. A liquid dispenser as claimed in claim 11 wherein in the closed position, the end wall of the cap engages the neck to close the container outlet opening preventing fluid flow there through and, in the open position, the end wall is spaced away from the container outlet opening.

13. A liquid dispenser as claimed in claim 12 wherein the side wall of the cap is disposed coaxially about the neck and the cap is axially movable relative the neck between the open position and the closed position.

14. A liquid dispenser as claimed in 1 including a motor operatively coupled to the impeller,

the motor located below the end wall of the cap ,

a rotatable shaft coaxial with the axis passing in a sealed relation through the end wall of the cap and coupled at a lower end to the motor and at an upper end to the impeller.

15. A liquid dispenser as claimed in claim 1 wherein the cap further includes a support portion extending downwardly to support surfaces to engage a planar work surface to support the dispenser in a vertical position for use in dispensing.

16. A liquid dispenser as claimed in claim 15 wherein the cap further includes a support portion extending downwardly to support surfaces to engage a planar work surface to support the dispenser in a vertical position for use in dispensing, and

a chamber is defined below the base of the cap within the support portion, the motor received within the chamber.

17. A liquid dispenser as claimed in claim 15 wherein the motor is an electric motor, and batteries for powering the motor are received in the chamber.

18. A liquid dispenser as claimed in claim 1 including a motor operatively coupled to rotate the impeller when activated, and a switch mechanism to activate the motor, and

wherein liquid may be dispensed by either rotation of the impeller on activation of the motor or by manually compressing the container .

19. A liquid dispenser as claimed in claim 18 including a mechanism for manual engagement to compress the container selected from one of a lever having a first portion which bears on a side surface of the container and a second portion available to be manually moved so as to urge the first portion to compress the side surface of the container and reduce the internal volume, and

a resilient bulbous portion forming a portion of a side wall of the container for manual deformation to reduce the internal volume of the container .

20. A liquid dispenser comprising:

an enclosed resilient container enclosed but for having at one lower end of the container a neck open at a container outlet opening,

the container outlet opening in sealed communication with a chamber forming element defining a chamber,

the chamber having an air inlet and a liquid inlet,

the liquid inlet open to the chamber at a height which is below a height at which the air inlet is open to the chamber,

the air inlet in communication with air at atmospheric pressure such that the chamber is at atmospheric pressure,

the liquid inlet connected via a liquid passageway with liquid in the container,

the liquid inlet at a height below a height of liquid in the container such that when pressure in the container is atmospheric pressure, due to gravity, the liquid from the container fills the liquid passageway and, via the liquid passageway, fills the chamber to a height above the height of the liquid inlet and below the height of the air inlet, and wherein on dispensing liquid from the container increases vacuum below atmospheric in the container , the height of liquid in the chamber decreases until the height of liquid is below the height of the liquid inlet and the liquid inlet is open to air in the chamber such that air in the chamber flows under gravity upward through the liquid passageway to the container to decrease vacuum in the reservoir,

an impeller rotatably received therein for rotation to draw liquid via the liquid passageway from the container and raise the height of liquid in the chamber above the height of the air inlet.

21. A liquid dispenser as claimed in claim 1 including a motor magnetically coupled to the impeller to rotate the impeller.

22. A liquid dispenser as claimed in claim 20 wherein the impeller when not rotating does not impede flow of air or liquid therepast.

23. A liquid dispenser as claimed in claim 22 wherein liquid in the dispenser may be dispensed by either compression of the container to reduce its volume or rotation of the impeller.

24. A liquid dispenser comprising:

a resilient, enclosed container enclosed but for having at one end of the container a neck open at a container outlet opening,

a cap having an end wall and a side wall of extending upwardly from the end wall to an remote portion of the side wall ,

a cap outlet opening through the side wall,

the cap received on the neck with the neck extending into the cap,

the remote portion of the cap about the neck engaging the neck to form fluid impermeable seal therewith,

a passageway defined between the neck and the side wall of the cap outwardly of the neck and inwardly of the side wall open to both the container outlet opening and the cap outlet opening,

the side wall of the cap being disposed about an axis,

the container outlet opening disposed coaxially within the side wall of the cap,

an impeller disposed in the cap above the end wall of the cap and at least partially below the container outlet opening journaled for rotation about the axis,

the impeller adapted on rotation to receive fluid above the impeller from the container outlet opening and to direct liquid radially outwardly into the passageway such that rotation of the impeller forces fluid into the passageway and out of the cap outlet opening.

25. A liquid dispenser as claimed in claim 24 wherein the cap is received on the neck for axial movement between an open position and a closed position,

in the closed position, the neck about the container outlet opening engages the side wall of the cap to prevent communication from the container outlet opening and the passageway,

in the open position, the neck about the container outlet opening is spaced from the side wall of the cap providing communication from the container outlet opening to the passageway.

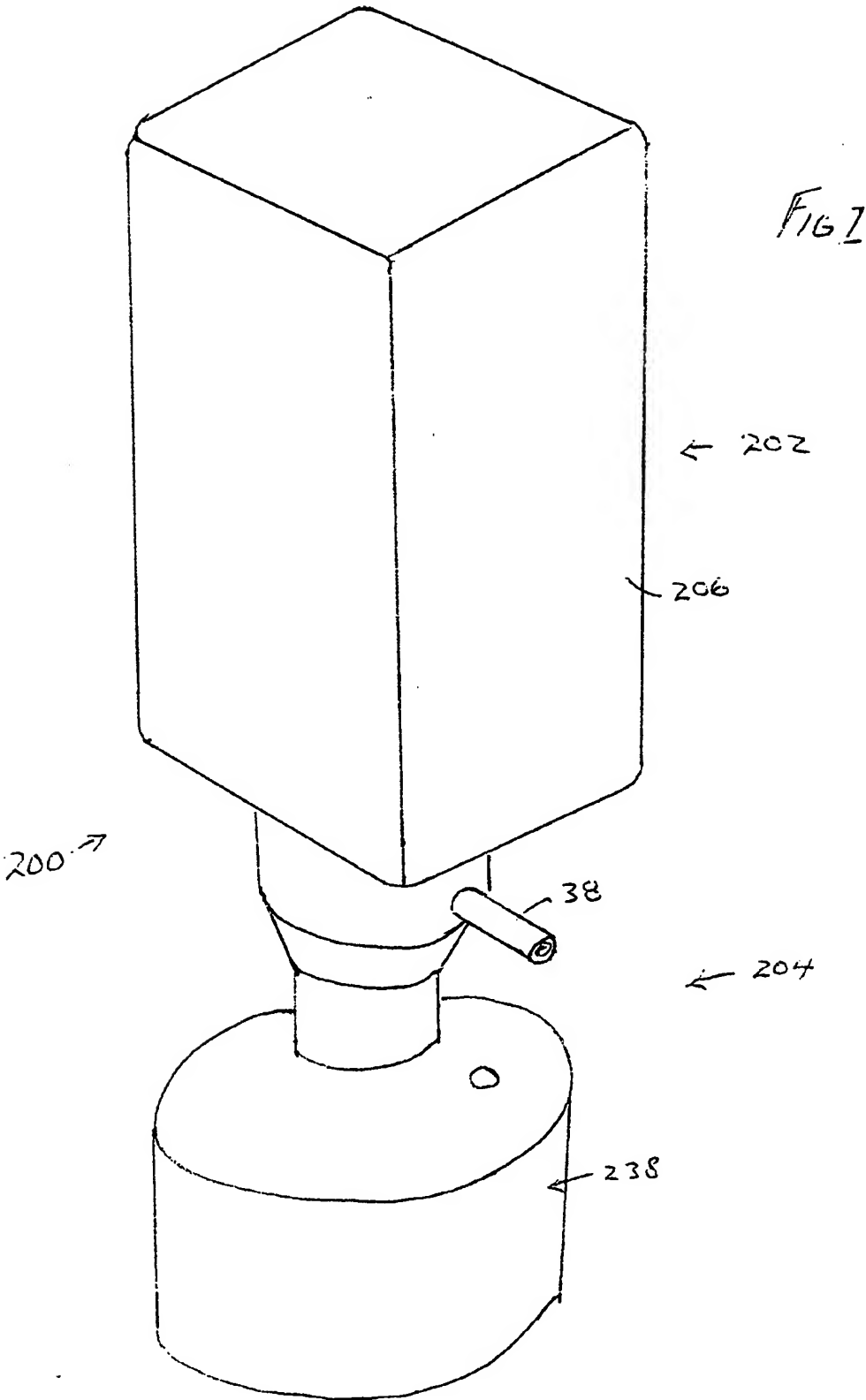


FIG 2

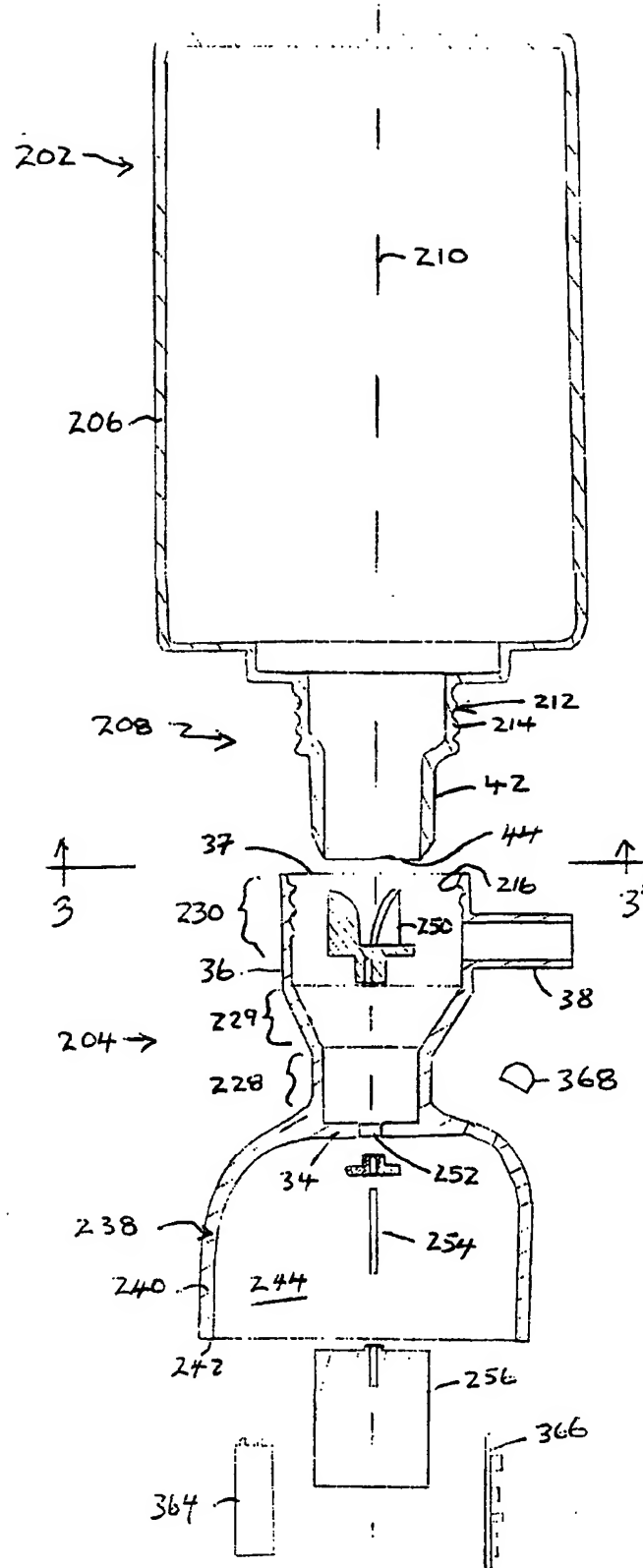


FIG 3

202
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206

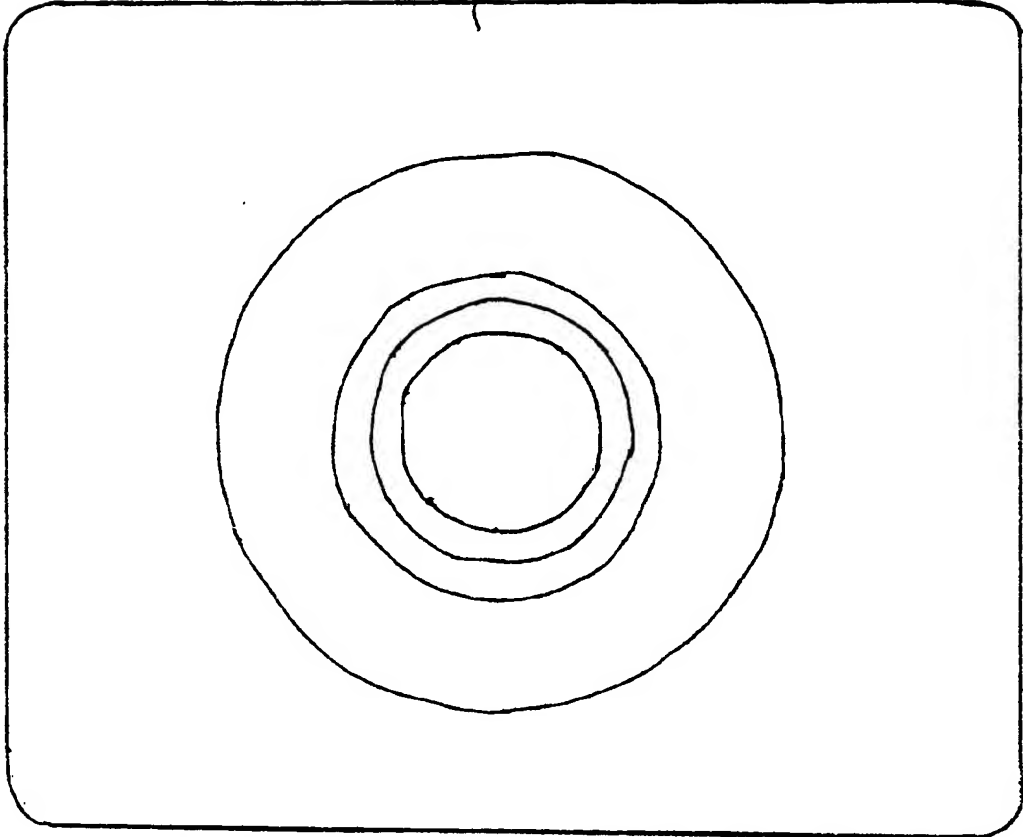
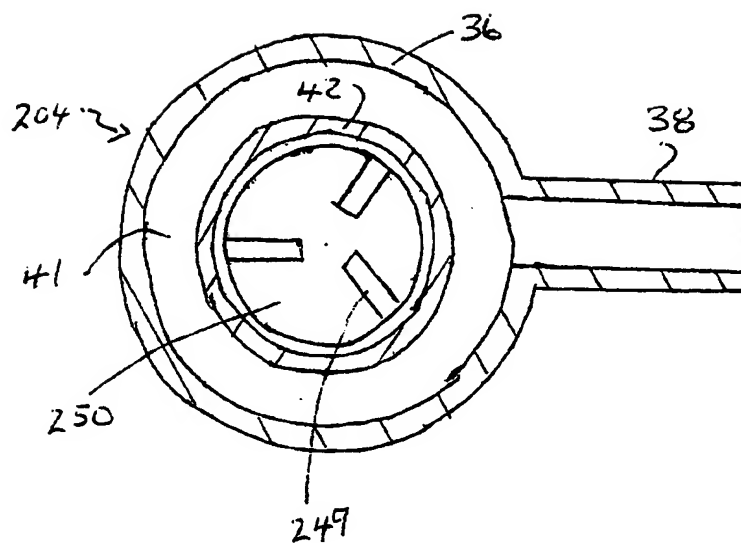


FIG 4



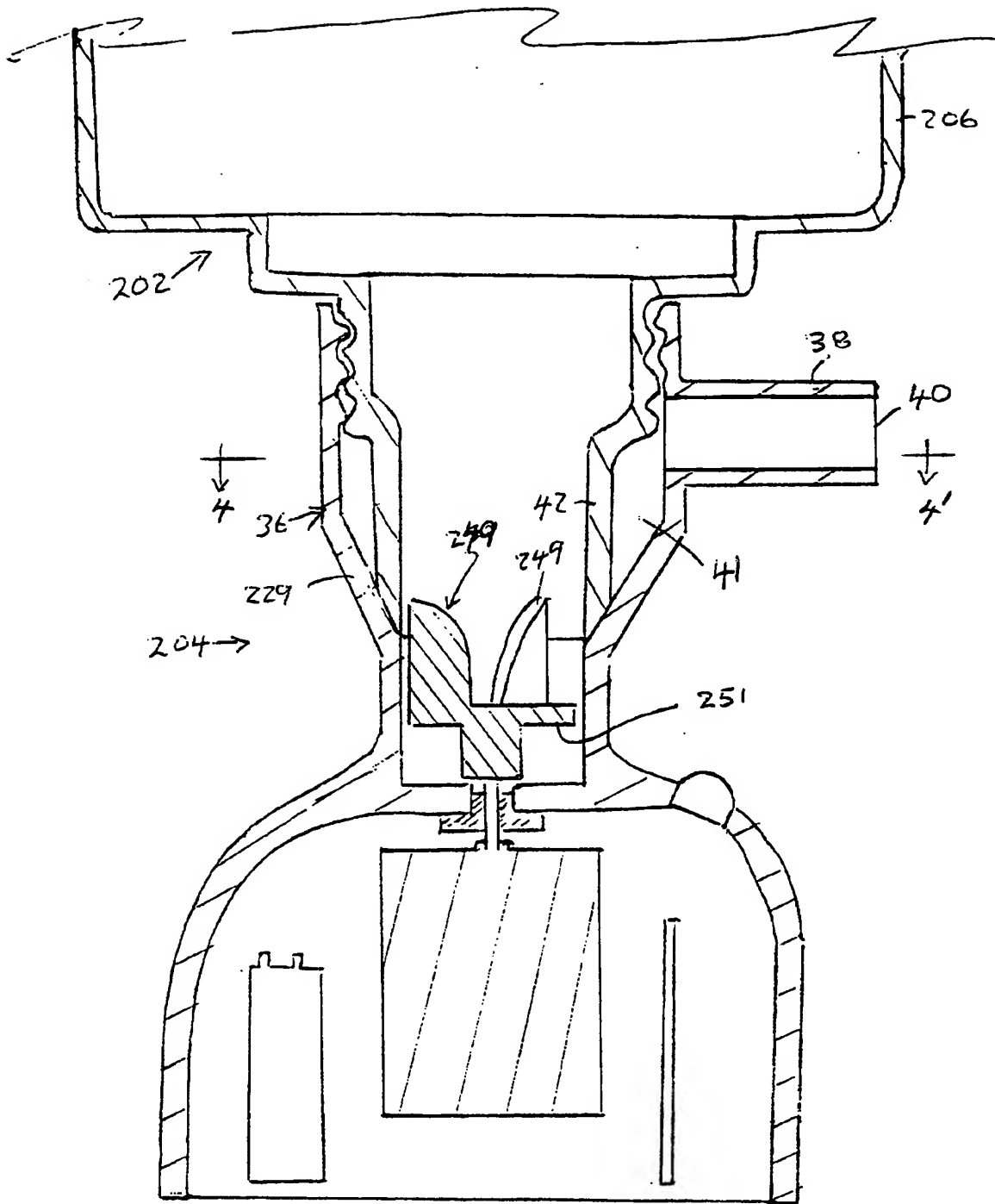


FIG 5

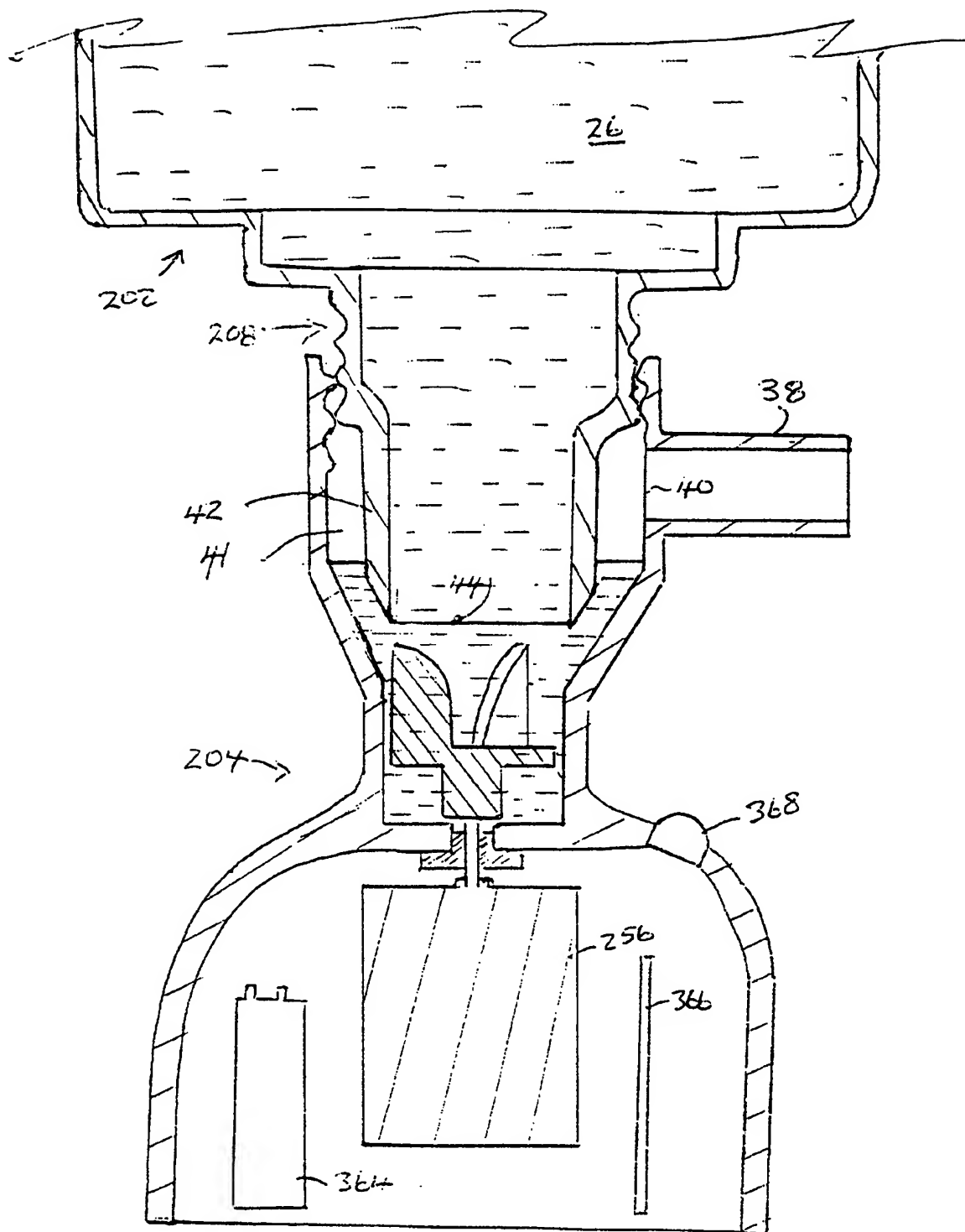


Fig 6

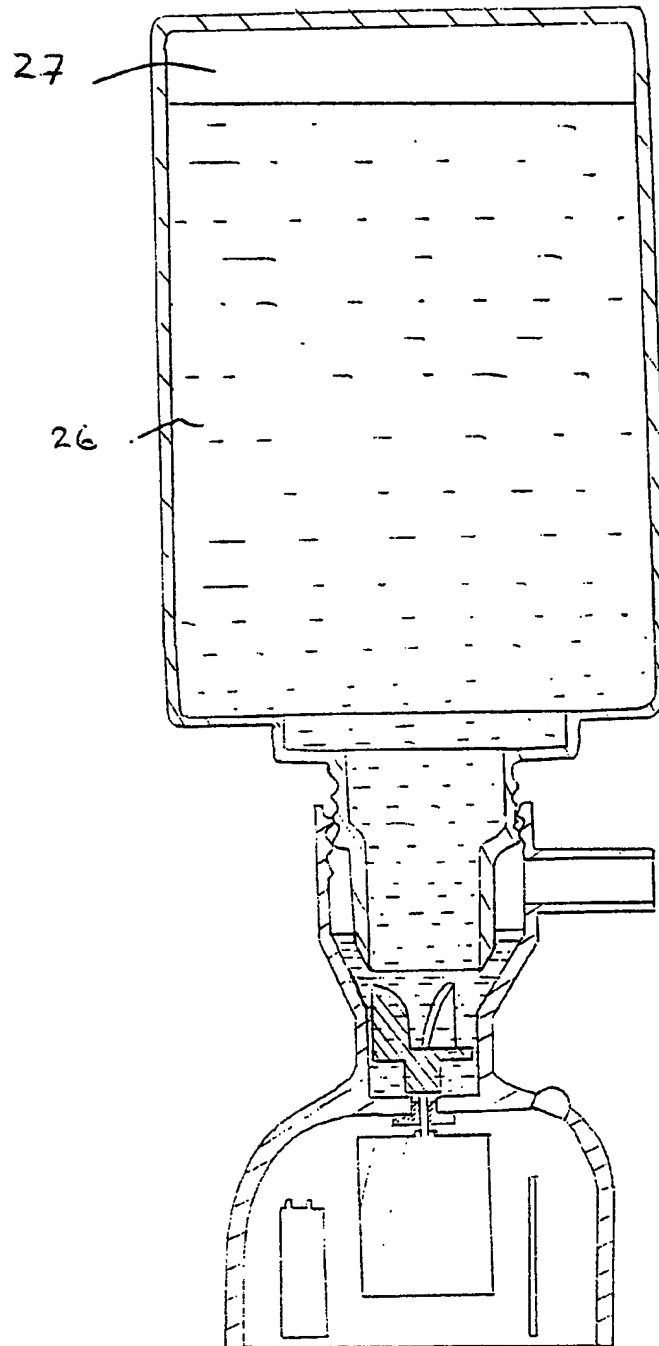


FIG 7

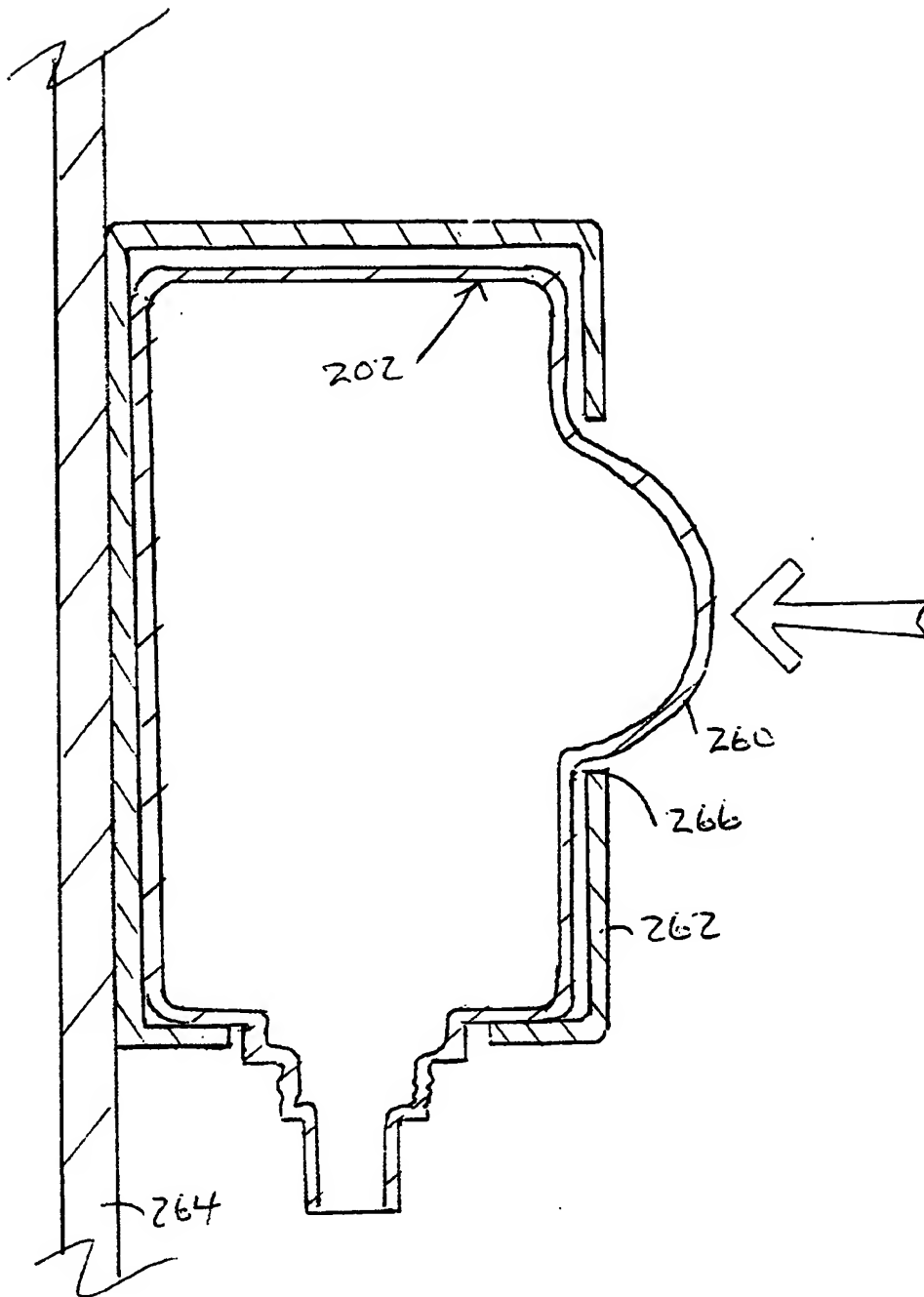


FIG 8

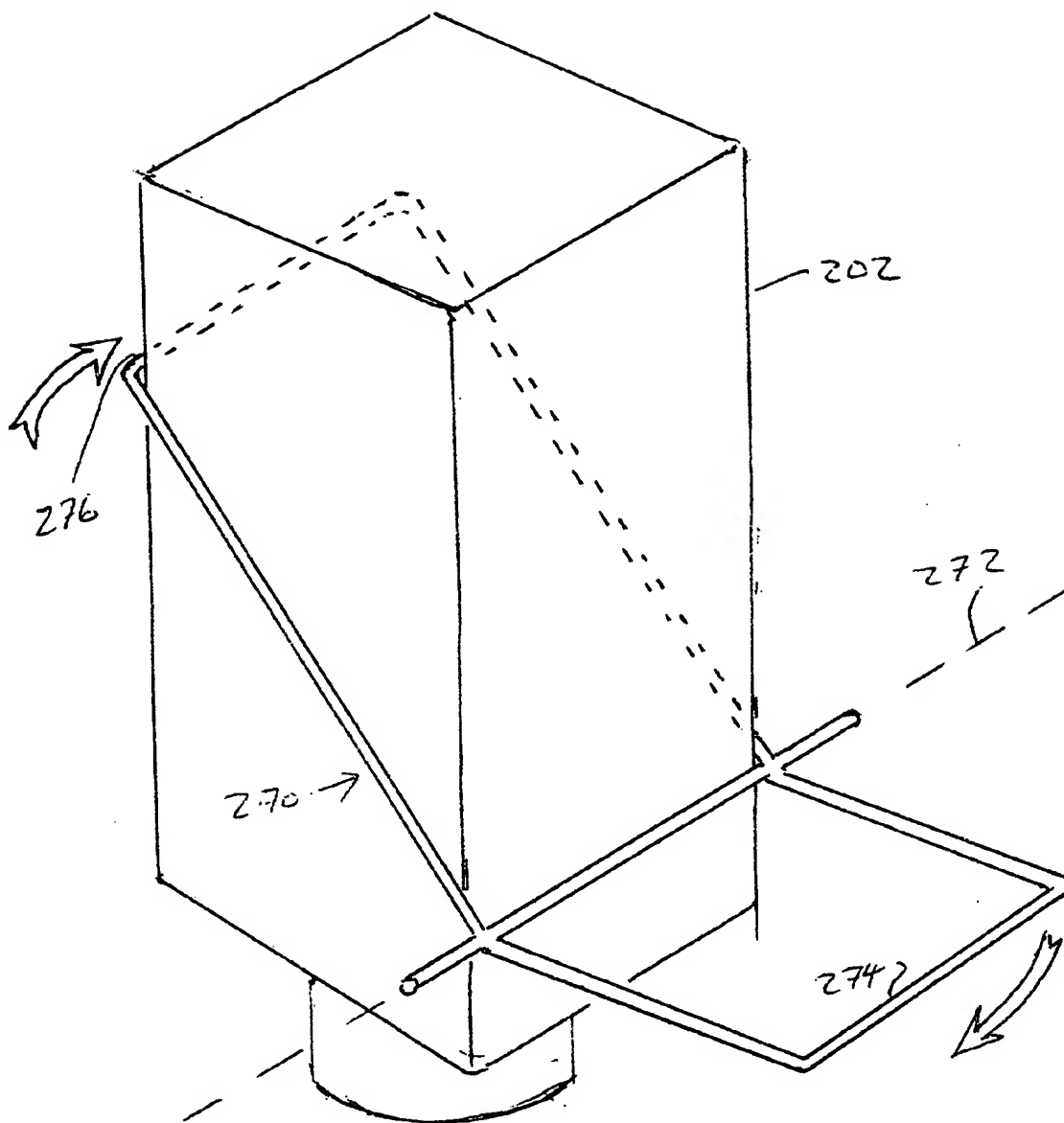
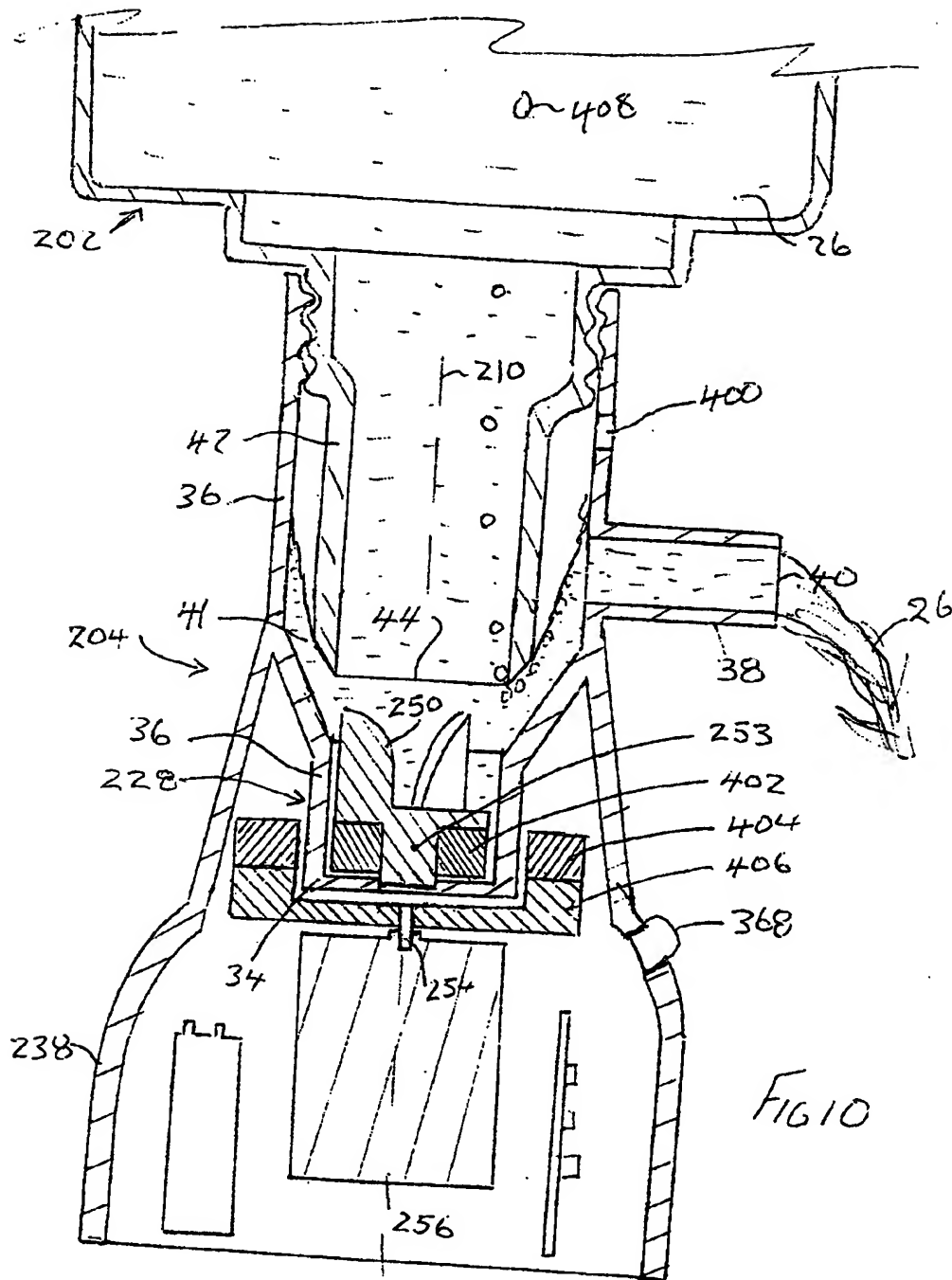
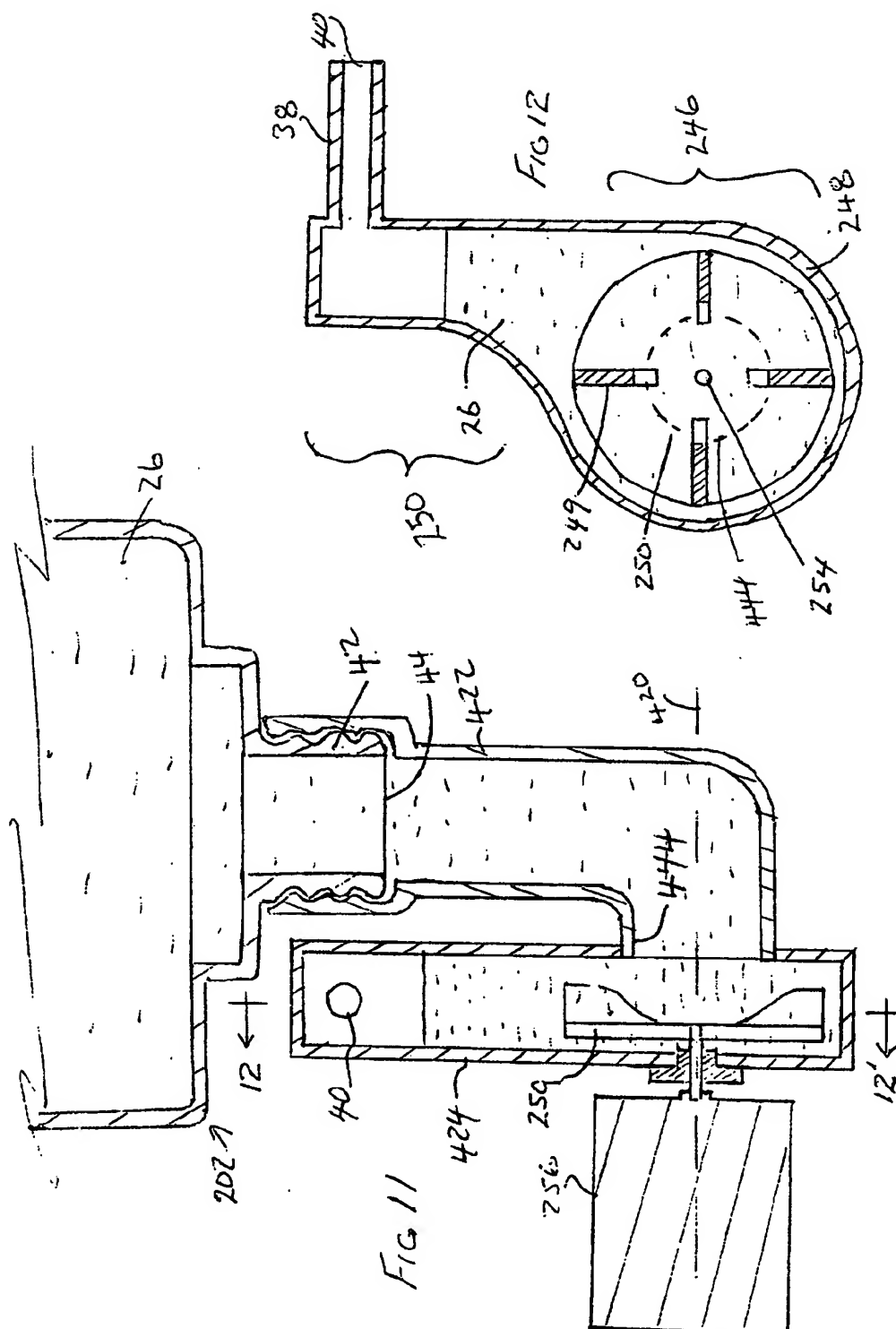


FIG 9





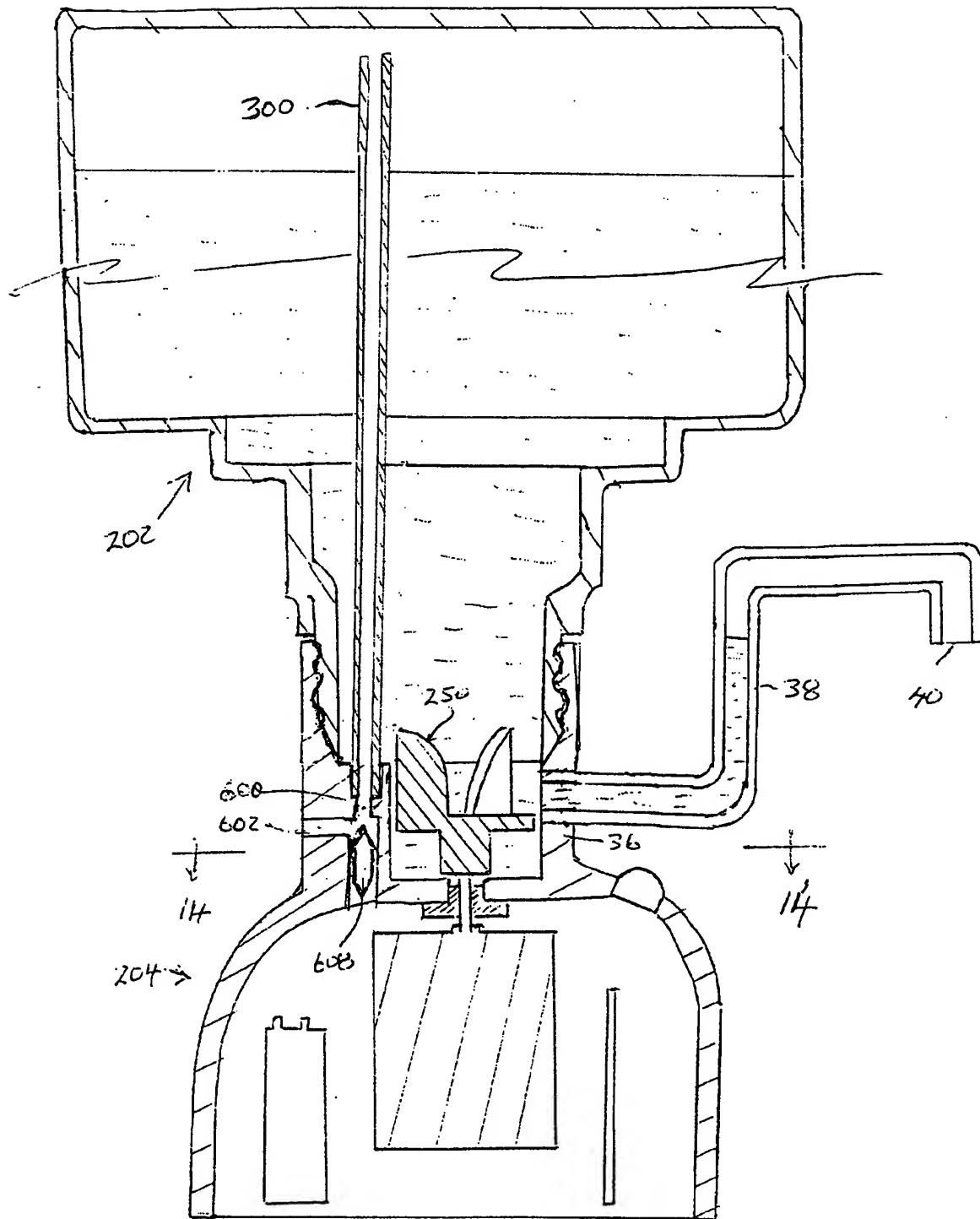


FIG 13

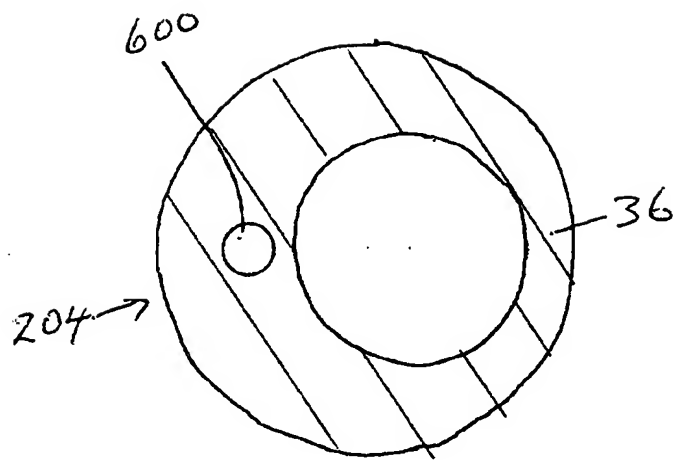


FIG 14

